

We are family: Family History of Diabetes among African Americans and its Association to Perceived Severity, Knowledge of Risk Factors, and Physical Activity Levels

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Abstract

This cross-sectional study sought to describe an association between family history of type-2 diabetes and the awareness of risk factors, perceived threat and physical activity levels in African Americans. With a prevalence of 11.8%, African Americans remain disproportionately affected by the epidemic of diabetes. A risk factor that cannot be modified, but is important and closely linked with diabetes expression, family history, can be a considerable tool in promoting behavior change and reducing the risk of developing the condition in African Americans. A self-report questionnaire was administered to 133 church going African Americans, with 55 of them with a positive family history of type-2 diabetes (41.4%) and 78 (58.6%) without. None of the participants had been previously been diagnosed with type-2 diabetes. The results from the study indicated that African Americans with positive family history had a greater knowledge of risk factors, were more likely to indicate that their concern about the disease influences their eating habits and physical activity, and engaged in significantly more physical activity than those with no family history.

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Introduction

In the United States, type-2 diabetes affects 8% of all adults. It is estimated that the incidence of individuals with a positive diagnosis of type-2 diabetes will increase by 165% between the years 2000 and 2050 (Narayan, Boyle, Thompson, Sorenson & Williamson, 2003). African Americans, as is the case with many chronic diseases, remain disproportionately burdened by the epidemic of type-2 diabetes. Compared to other racial groups combined, African Americans are 50% more likely to develop type-2 diabetes, and are 1.5 to 2.5 times more likely to have one or more limbs amputated due to diabetes-related complications (Medicine.net, 2004). It has been suggested that this elevated risk in African Americans is due to a genetic susceptibility to develop chronic diseases including diabetes (Signorello, Schlundt, Cohen, Steinwandel, Buchowski,

McLaughlin, et al., 2007). Other research suggests that in industrialized nations such as the United States, the development of type-2 diabetes is associated with environmental factors such as low socioeconomic status (Robbins, Vaccarino, Zhang, & Kasl, 2001).

Diabetes and Physical Activity

In the adult population, leisure time physical activity has been associated with lower rates of type-2 diabetes among men (Svartberg, Njolstad, & Schirmer, 2010), and a wide range of mild intensity (e.g., leisurely walking) to vigorous intensity (e.g., tennis and racquetball) physical activities among women (Hu, Sigal, Rich-Edwards, Colditz, Solomon, et al., 1999). The results of ten prospective studies that included over 300,000 adults indicated that moderate intensity physical activities such as brisk walking substantially reduce the risk of type-2 diabetes (Jeon, Lokken, Hu, & van Dam, 2007).

In the only known prospective study examining the link between physical activity and type-2 diabetes specifically among African Americans, James and colleagues (1998) followed over 1,110 participants with no prior history of diabetes for five years. Those who regularly engaged in moderate physical activity were 65% less likely to develop non-insulin-dependent diabetes mellitus (NIDDM or type-2 diabetes) compared to those who were inactive (James et al., 1998). Cross-sectional associations between low aerobic physical activity and type-2 diabetes have been found among African American college students (Owens, 2008).

Randomized controlled trials that contain a physical activity component and target African Americans with type-2 diabetes have yielded positive results. Specific outcomes include reduced hemoglobin A1C levels among older adults (Agurs-Collins, Kumanyika, Ten Have, & Adams-Campbell, 1997; Speer, Reddy, Lommel, Fischer, Heather, et al., 2008) and lowered fasting insulin levels among African American women (Irwin, Mayer-Davis, Addy, Pate, Durstine, et al., 2000; van Rooijen, Rheeder, Eales, & Becker, 2004). Hence, physical activity is a critical factor in the prevention of type-2 diabetes among African Americans.

Family History of Type-2 Diabetes and Preventive Behaviors

A non-modifiable risk factor that is closely linked to diabetes expression is family history. A family history of type-2 diabetes not only represents an inherited genetic susceptibility; it also represents shared environmental factors that include cultural values and practices such as food choices and exercise habits (Baptiste-Roberts, Gary, Beckles, Gregg, Owens, Porterfield, et al., 2007). Individuals who have at least one family member with type-2 diabetes are more likely to have healthier diets (e.g., consume five or more fruits or vegetables per day), engage in physical activity regularly, and get screened for type-2 diabetes compared to those with no family history (Baptiste-Roberts et al., 2007; Forsyth and Goetsch, 1997; Harrison, et al., 2003).

Family history of type-2 diabetes has often been defined as having at least one parent or sibling who has been medically diagnosed with the disease. However, the type-2 diabetes status of grandparents, cousins, uncles and aunts may also strongly influence one's own type-2 diabetes status among African Americans, beyond their genetic similarities, as it is common for extended family members to live in one household (Pinderhughes, 2005).

The Health Belief Model

We used the Health Belief Model (HBM; Glanz, Rimmer & Lewis, 2002) to explain the relationship between family history of type-2 diabetes and individual preventive behaviors. A few of the key constructs in this model include perceived susceptibility, perceived severity, and knowledge. The model assumes that individuals are more likely to modify their behaviors (for example, engage in more physical activity) if they perceive that they are susceptible to developing diabetes, that the consequences of developing diabetes are severe, and that they have knowledge about the disease. Baptiste-Roberts and colleagues (2007) and Forsyth and Goetsch (1997) demonstrated that perceived susceptibility and perceived severity were associated with diabetes risk awareness and physical activity within the African American community. HBM constructs are associated with type-2 diabetes protective factors among other ethnic groups as well. For example, perceived susceptibility (Macaden & Clarke, 2006) and perceived severity (Park, Kim, Kim, Kam, & Kim, 2010) are associated with diabetes self-management behaviors among older Asians. In the Netherlands, results from a randomized controlled trial indicated that individuals who are informed about their familial risk of diabetes were more likely to eat a more healthy diet (Pijl, Timmermans, Claassen, Janssens, Nijpels, et al., 2009).

The Present Study

No known studies have examined whether a history of type-2 diabetes within the extended family (e.g., grandparents, aunts, uncles, cousins) is associated are linked to perceptions

that may influence diabetes preventive behaviors, specifically among African Americans. To address this gap in the literature, this study examined whether the Health Belief Model constructs of perceived susceptibility, perceived severity, and knowledge about diabetes, as well as level of physical activity differed in African Americans with a positive family history of diabetes (including parents, siblings, grandparents, aunts, uncles, and cousins) compared to African Americans without a family history.

This study consisted of two hypotheses. The first hypothesis was African Americans with a family history of diabetes would have a greater awareness of the risks associated with the development of type-2 diabetes than an individual without a family member with the disease. The second hypothesis was that African Americans with a family history of type-2 diabetes would have a greater perceived threat (perceived susceptibility and severity) of developing the disease and as a result would have participated in more physical activity than African Americans without this family history.

Methods

Participants

The target population of this study consisted of males and females between the ages of 18 and 65, who identified themselves as African American, and had never received a medical diagnosis of type-2 diabetes mellitus. "African American" was defined as any citizen or current resident of the United States whose ethnic origin is tied to any of the black racial groups of Africa. For the study there was no restrictions placed on a person's body mass index (BMI), height or weight because participants with a wide range of risk levels were desired for the study. Participants for this study were African Americans who were members of Southern California religious congregations (churches). We believed that this sample appropriately represented the African American population for the purposes of this study, since Kim and Sobol (2004) found no differences between those with religious affiliations and those without religious

affiliations on fat intake and physical activity overall in a U.S. sample.

One hundred and fifty seven participants approached us after the religious service to complete the self-administered questionnaires. The definition of diabetes and its impact on the African American community was explained to the participants on the questionnaire cover page. After the elimination of incomplete surveys and ineligible participants (those who answered being diabetic or pre-diabetic in the questionnaire), 133 participants (84.7%) were left and they comprised the analytic sample. At the time of analysis there were 58 male (43.6%) and 75 female (56.4%) participants; 55 (41.4%) participants had a family history of type-2 diabetes and 78 (58.6%) participants had no family history of type-2 diabetes. This sample size allowed us to detect, with 80% power and a Type I error rate of .05, the following differences between those with a family history and those without a family history of diabetes: (1) a .50+ standard deviation unit difference in physical activity levels, and (2) a 19% + difference in rates of diabetes knowledge, perceived susceptibility, and perceived severity. The minimum sample size required for this power was 84 participants (42 with a family history and 42 without a family history). These calculations corresponded to "medium" effect sizes (Kraemer & Thiemann, 1987).

Measures

Family history of diabetes. Family history of diabetes was the primary independent variable in this study. Participants were asked, "Who in your family has type-2 (non-insulin dependent) diabetes?" This question was dependent on medical diagnosis. The question used to assess family history was adapted from the questionnaire originally used by Baptiste-Roberts and Colleagues (2007) to assess family history of diabetes in African Americans and was modified to include extended family simpler answering. Answers to this question were parents, siblings, children, aunts/uncles/cousins and grandparents. Participants checked the box next to the family member to indicate that person was diagnosed with diabetes. Participants

who indicated that at least one of the relatives listed had diabetes were considered “positive” for family history of diabetes. Those who did not indicate that any of the relatives listed had diabetes were considered “negative.”

Diabetes knowledge. Knowledge of seven known risk factors for diabetes (older age, family history, being overweight, lack of exercise, being an ethnic or racial minority, having an energy dense diet, and gestational diabetes) was assessed. The questions used to assess diabetes knowledge was taken from the questionnaire originally used by Baptiste-Roberts and Colleagues (2007) to assess knowledge of risk factors in African Americans and were presented with a 4 point Likert scale. Participants were asked to classify each risk factor as “definitely does not increase,” “probably does not increase,” “probably increases,” and “definitely increases” the risk of developing type-2 diabetes. Correct answers for all of the questions were “probably increases” and “definitely increases”, while incorrect answers were “definitely does not increase” and “probably does not increase.” Answers for each of the seven risk factors was assessed separately and summed up to determine awareness of risk factors.

Perceived susceptibility and perceived severity

Perceived susceptibility and perceived severity of developing type-2 diabetes was assessed with 4 questions. The perceived susceptibility questions were: “I consider my own risk for type-2 diabetes to be very low” and “the concern of type-2 diabetes influences how I eat and my daily physical activity.” The perceived severity questions were: “I would have an extremely difficult time coping with type-2 diabetes” and “developing type-2 diabetes would cause major depression for me.” Answers to these questions were on a Likert scale and included: “strongly agree”, “agree”, “disagree”, and “strongly disagree.” Participants were categorized as “susceptible” for the susceptibility questions and “high perceived severity” for the severity questions if they answered either “strongly agree” or “agree” to the respective questions. These items were adapted from the HIV/AIDS

Questionnaire originally used by Bridgers, Figler, Vaughan, and Sawain (1990), who found acceptable internal consistency reliability for their perceived susceptibility (Cronbach’s $\alpha = 0.81$) and perceived severity (Cronbach’s $\alpha = 0.70$) scales.

Physical activity

Physical activity was assessed with six questions from the International Physical Activity Questionnaire (IPAQ; Craig, Marshall, & Sjostrom, 2003). IPAQ facilitates the assessment of metabolic equivalent (MET), which is a ratio that compares metabolic rate while resting to metabolic rate while performing a specific task. The IPAQ scoring protocol classifies the following values for MET: 3.3 MET for walking, 4.0 MET for moderate intensity activities and 8.0 MET for vigorous intensity activities. For each intensity level, the base METs were multiplied by the reported minutes of the activity per day and then by the reported total days per week that the intensity level was performed. The total MET-minutes/week variable was the sum of the low, moderate and vigorous MET-minutes/week calculations. The short IPAQ questionnaire has high test-retest validity (Spearman’s rho ranging from 0.65 to 0.88) and concurrent validity (Spearman’s rho = .65; Craig, Marshall, & Sjostrom, 2003).

Demographic characteristics

The last section of the questionnaire consisted of 7 demographic questions: ethnicity (an inclusion criterion for this study, as only black racial groups were included in this study), age in years, weight in pounds and height in inches (to calculate BMI), gender, annual household income, and highest level of education completed.

Procedures

All of the procedures received approval from the Institutional Review Board of the authors’ affiliation prior to data collection. To conduct the study, participants were recruited from black ethnic Christian church congregations in the Southern California area. The churches were identified through online databases (samples of convenience). To obtain permission for data collection, the heads of each congregation were

contacted by phone and the purpose of study was explained and if permission was granted a date and time was set. The Pastor announced the study and encouraged any willing participants to meet at a designated area within the church after the religious services. Individuals who expressed interest were given a consent form, questionnaire with cover letter, pen, and clipboard by one of four survey collectors, including the primary researcher. The definition of diabetes, its impact on the African American community, and questionnaire instructions were explained to the participants on the questionnaire cover page. Participants placed their completed questionnaires and consent forms in a locked survey collection box. On average, participants spent approximately 10 minutes to complete the survey. As an incentive, participants were provided with a pamphlet about type-2 diabetes, the American Diabetes Association's (ADA) Diabetes Risk Test, and a raffle ticket for a \$20 gift certificate.

Statistical Analysis

Data were entered into and analyzed using SPSS version 16.0 (2007). Descriptive statistics were calculated for the demographic variables. After converting physical activity into metabolic equivalents (METs-minutes/wk), the mean, standard deviation, skewness, and kurtosis statistics were calculated. The independent variable was family history status (positive or negative). Bivariate analyses to test hypotheses included Pearson's chi-square tests to examine differences between the positive family history and the negative family history groups on each separate diabetes knowledge variable, each perceived susceptibility variable, and each perceived severity variable. A Kruskal-Wallis test was performed to compare the two groups on physical activity levels. Last, multiple linear regression and multiple logistic regression modeling was performed to test the hypotheses adjusting for demographic variables (gender, age, BMI, education and income) that were found to be statistically related to the dependent variable alone.

Results

Demographic Characteristics of the Sample

Participants were 43.6% male ($n = 58$) and 56.4% female ($n = 75$). Mean age was 35.9 years ($SD = 12.9$). The completion of some high school was reported by 3.8% of participants ($n = 5$), while 29.3% ($n = 39$) were high school graduates or completed the GED, 33.1% ($n = 44$) held an associate or vocational degree, 27.8% ($n = 37$) held a bachelors degree, and 6.0% ($n = 8$) held a masters degree or higher. The reported household income was below \$20,000 for 27.1% of respondents ($n = 36$), \$20,000-\$39,999 for 11.3% of them ($n = 15$), \$40,000-\$79,000 for 39.7% ($n = 53$), and \$80,000 or greater for 21.7% ($n = 29$). The means for weight and height were 185 pounds ($SD = 36.12$) and 67.27 inches ($SD = 3.98$), respectively, while the mean BMI was 28.9 kg/m² ($SD = 5.95$). Participants spent a mean of 2.2 days ($SD = 2.0$) per week engaging in vigorous physical activity, with an average 42.68 minutes ($SD = 43.9$) of vigorous activity per day. They also spent a mean of 3.8 days ($SD = 8.8$) per week engaging in moderate physical activity, with a mean of 54.66 minutes ($SD = 63.4$) of moderate physical activity per day. Participants spent a mean of 5.8 days ($SD = 8.6$) per week walking 10 minutes or more, with a mean 50.7 minutes per day ($SD = 66.0$) of walking. Taken together, these indicators of physical activity corresponded to mean physical activity level of 2165.6 MET-minutes/wk ($SD = 1527.4$).

Diabetes Knowledge by Family History

Outcome variables are presented by family history status on Table 1. There was no significant difference between those with and without a family history of diabetes on diabetes knowledge pertaining to family history ($\chi^2 = 0.16$, $p = 0.69$), older age ($\chi^2 = 2.89$, $p = 0.09$), being overweight ($\chi^2 = 0.07$, $p = 0.79$), lack of exercise ($\chi^2 = 3.04$, $p = 0.08$), and gestational diabetes ($\chi^2 = 0.35$, $p = 0.55$). However, participants with a family history were more

knowledgeable than those without a family history with regards to diabetes knowledge pertaining to being an ethnic or racial minority ($\chi^2 = 4.86$, $p = 0.03$) and having a high calorie diet ($\chi^2 = 4.35$, $p = 0.03$).

Perceived Susceptibility and Perceived Severity by Family History

There was no significant difference between those with and without a family history of diabetes on perceived risk for developing the disease ($\chi^2 = 0.01$, $p = 0.92$). However, those

with a positive family history more often reported that their concern of diabetes influences their diet and physical activity compared to those with a negative family history ($\chi^2 = 17.55$, $p = 0.000$). Furthermore, those with a positive family history were more likely to agree that they would have a difficult time coping with type-2 diabetes ($\chi^2 = 7.251$, $p = 0.007$), and that the disease would cause major depression ($\chi^2 = 18.80$, $p = 0.000$) relative to those with a negative family history. See Table 1.

Table 1

Dependent Variables by Family History				
	Family History (n= 55) n (%)	No Family History (n= 78) n (%)	χ^2	P
<u>Risk Knowledge</u>				
Positive family history	37(67.2)	55 (70.5)	0.16	0.69
Older age	39 (70.9)	44 (56.4)	2.89	0.09
Being overweight	42 (76.4)	58 (74.4)	0.07	0.79
Lack of exercise	46 (83.6)	55 (70.5)	3.04	0.08
Ethnic/racial minority	40 (72.7)	42 (53.8)	4.86	0.03
High calorie diet	45 (81.8)	51 (65.4)	4.34	0.04
Gestational diabetes	44 (80.0)	59 (75.6)	0.35	0.55
<u>Perceived Susceptibility</u>				
High risk of diabetes onset	20 (36.3)	29 (37.2)	0.01	0.92
Concern and eating habits	48 (87.2)	41 (52.6)	17.55	<0.0001
<u>Perceived Severity</u>				
Hard time coping	44 (80.0)	45 (57.7)	7.25	0.01
Depressed if diabetic	44 (80.0)	33 (42.3)	18.80	<0.0001
	Mean (SD)	Mean (SD)	Mann-U	P
<u>Physical Activity</u>				
MET-minutes/week	3021.8 (1623.0)	1562.0 (1122.1)	1057.5	<0.0001

Physical Activity by Family History

Based on the results of the skewness statistic and standard error, the physical activity variable had significant skewness. For this reason, the Mann-Whitney U test, a non-parametric test, was performed to determine the physical activity

level of those with and without family history of type 2 diabetes. The results indicated that those with a positive family history engaged in more physical activity ($M = 3021.8$ MET-minutes/wk, $SD = 1623.0$) relative to those with a negative family history ($M = 1562.0$ MET-minutes/wk,

SD = 1122.1; Mann-Whitney U = 1056.5, p <.0001).See Table 1.

Adjusted Associations of Family History on Perceived Susceptibility, Perceived Severity, and Physical Activity

Subsequent analyses were performed to determine whether the associations between family history and the dependent variables remained significant after statistically adjusting for demographic variables that were significantly associated with the given dependent variable. For example, gender, but not education or income, was associated with the “ethnic minority” risk knowledge variable. Therefore, logistic regression analysis of the ethnic minority variable was statistically adjusted for gender only. The analyses presented here were restricted to those dependent variables

that were significantly associated with family history, as seen in Table 1.

The results indicated that statistical adjustment for the demographic variables did not alter the significant relationships between family history and dependent variables. Those with a negative family history were significantly less knowledgeable of specific risk factors (ethnic minority status and high caloric intake). Those with a negative family history also less frequently endorsed the statement that their eating habits are controlled by their concern of type-2 diabetes onset, and that type-2 diabetes onset would cause them major depression. A negative family history was also associated with less physical activity. Further details are provided in Table 2.

Table 2

Regression Analysis of Select Dependent Variables on Negative Family History of Diabetes						
Predictor	Dependent Variables					
	Risk Knowledge		Perceived Susceptibility	Perceived Severity		Physical Activity
	Ethnic Minority ^a	Hi-Calorie Diet ^b	Eating Habits ^b	Hard Time Coping ^c	Depressed if Diabetic ^b	MET-min. per week ^c
Negative family history						
Odds Ratio	0.41	0.44	0.16	0.33	0.19	β: -0.48
95% CI	0.19, 0.89	0.19, .0.99	0.07, 0.41	0.15, 0.75	0.08, 0.42	
p	0.03	0.05	<0.0001	0.01	<0.0001	<0.0001

^a Adjusted for gender.

^b Adjusted for education.

^c Adjusted for income.

Discussion

This study expanded upon similar studies in a few ways. First, we took into consideration the collectivist nature of African American family networks by including both primary family members (parents, siblings, and children) as well as secondary family members (aunts, uncles, nieces, nephews, and grandparents) when

assessing family history of type-2 diabetes. Previous studies (e.g., Baptiste-Roberts et al., 2007) have only considered primary family members when assessing family history. Second, no known study of type-2 diabetes has examined the association of positive family history with health belief model constructs and physical activity levels. Third, with the exception of the study conducted by Baptiste-Roberts and

colleagues (2007), there have been no other published studies to date that focused upon family history of type-2 diabetes and health protective behaviors among African Americans, solely.

The results from the study supported the hypotheses that African Americans who have not had type-2 diabetes themselves, but have a positive family history of the disease, have a greater knowledge of risk factors (two out of the seven risk factors studied). Baptiste-Roberts and colleagues (2007) found that African Americans with a positive family history, which only included parents and siblings, were more knowledgeable than those without a family history on four type-2 diabetes risk factors. They were the following: being overweight, having a positive family history, lack of sufficient exercise, and a high calorie diet. We studied knowledge of these four risk factors in our study as well; however only the high calorie diet knowledge variable was significantly linked to a positive family history of type-2 diabetes. Our modest findings for knowledge of risk factors may be attributable to a couple of different factors: (1) the majority of the sample, regardless of their family history status, was knowledgeable about all of the risk factors assessed in this study, and (2) the type-2 diabetes status of extended family members may not necessarily contribute as strongly to increased knowledge of risk factors compared to the status of parents and siblings.

We observed that African Americans with a positive family history for type-2 diabetes were more likely to indicate that their concern about type-2 diabetes influences their eating habits and physical activity. This finding mirrors those found by Baptiste-Roberts and colleagues (2007) and Forsyth and Goetsch (1997). However we also found that those with a positive family history were not any more likely than those with a negative family history to believe that they were at an increased risk for the disease. Since positive family history by itself is a risk factor for type-2 diabetes, African Americans with a positive family history should be encouraged to visit their health care provider for routine screenings, regardless of their lifestyle

behaviors. Such an approach is feasible, especially since our findings also suggested that those with a family history of type-2 diabetes were far more likely than those without a family history to believe that the consequences of their own diabetes onset would be more severe.

Last, our study found that those with a positive family history of type-2 diabetes engaged in significantly more physical activity than those with no family history. Similarly, Forsyth and Goetsch (1997) found that a positive family history for chronic diseases in general was associated with increased participation in daily exercise, but their sample consisted of several ethnic groups and included only primary family members (parents and siblings).

Limitations

A few limitations that were not discussed earlier should be mentioned. Participants were recruited from churches in Southern California; therefore, the findings in this study cannot be generalized to all African Americans that reside in the United States. Second, all of the data obtained for the study was by self-report, which may have resulted in biased estimates of some variables, for example, physical activity level and the type-2 diabetes status of all of their family members. Additionally, since participants were asked to put a check next to each family member that had diabetes instead of answering yes or no, it is impossible to determine whether those assessed as not having a positive family history truly did not have a family history or failed to answer each question. Finally due to the cross-sectional design of our study, it is not clear whether knowledge of risk factors and perceived severity of type-2 diabetes resulted in an increase in physical activity. Longitudinal studies are needed to provide evidence of causal relationships.

Implications

The findings from this study suggest that those with a positive family history of type-2 diabetes are more likely to view the consequences of the disease as more severe, perhaps due to firsthand interactions with family members who are suffering from the disease. A focus group study could further clarify how the occurrence of type-

2 diabetes among African Americans influences the attitudes beliefs, and behaviors of family members who have not yet developed the disease. Furthermore a longitudinal study is needed to determine the direction of the associations among family history, perceived severity, and physical activity level variables.

Such a study would further inform interventionists as to whether increasing individuals' perceived threat of diabetes is an effective strategy to foster health protective behaviors such as physical activity, and whether this strategy may be equally effective for those with and without a family history of diabetes.

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